BRITISH COLUMBIA
MINISTRY OF FORESTS

Tree Farm Licence 49

Issued to Riverside Forest Products Limited

Rationale for
Allowable Annual Cut (AAC) Determination

Effective December 22, 1998

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Chief Forester

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Objective of this Document

This document is intended to provide an accounting of the factors I have considered and the rationale I have employed as chief forester of British Columbia in making my determination, under Section 8 of the *Forest Act*, of the allowable annual cut (AAC) for Tree Farm Licence (TFL) 49. This document also identifies where new or better information is required for incorporation into future determinations.

Description of the TFL

TFL 49 is located west of Okanagan Lake near the communities of Kelowna, Vernon and Armstrong in the Southern Interior region of B.C. The TFL is held by Riverside Forest Products Limited (Riverside) and is administered by the Vernon and Penticton Forest Districts which are both part of the Kamloops Forest Region.

TFL 49 lies within one of the most ecologically diverse regions of the province and encompasses five biogeoclimatic zones: Ponderosa Pine (PP), Interior Douglas-fir (IDF), Interior Cedar Hemlock (ICH), Montane Spruce (MS) and Engelmann Spruce Subalpine Fir (ESSF). The total land base used in the analysis for TFL 49 is 143 760 hectares of which 135 424 hectares (94 percent) are considered productive forest. The remaining 8 336 hectares (six percent) are composed largely of alpine areas, rock, lakes, swamp, non-typed areas and existing roads. The varied topography and climate of the licence area supports a variety of commercial tree species including Douglas-fir, lodgepole pine, spruce, and balsam (true firs).

The region is considered to have a relatively diversified economy with forestry, manufacturing, construction, agriculture and tourism being the primary generators of employment.

History of the AAC

TFL 49 was first issued to Crown Forest Industries in July 1985. The licence was assigned as a result of the consolidation of the company's three interior TFLs—TFLs 9, 16, and 32—into a single unit. During the term of Management Plan (MP) No. 1, the timber harvesting land base of the TFL was 130 906 hectares and the company was authorized to harvest 380 000 cubic metres per year from a total licence area of 144 923 hectares.

In November 1992 the TFL was assigned to Riverside (the "licensee"). MP No. 2 was approved in January 1994 and the AAC remained at 380 000 cubic metres per year and included a volume of 36 905 cubic metres administered by the Small Business Forest Enterprise Program (SBFEP). Under MP No. 2, the total TFL area was 144 923 hectares and included a timber harvesting land base of 122 569 hectares.

Riverside has acquired additional timber harvesting agreements and production facilities in recent years and the company has a significant presence in the Southern Interior.

New AAC determination

Effective December 22, 1998, the new AAC for TFL 49 will be 380 000 cubic metres, the same as the current level. This AAC includes 36 905 cubic metres administered under the SBFEP.

This AAC will remain in effect until a new AAC is determined, which must take place within five years of this determination.

Information sources used in the AAC determination

Information considered in determining the AAC for TFL 49 includes the following:

- Statement of Management Objectives, Options and Procedures (SMOOP) for Draft Management Plan No. 3, TFL No. 49, accepted June 25, 1997;
- Existing stand yield tables for TFL 49, approved by BCFS Resources Inventory Branch, January 30, 1998;
- Managed stand yield tables and site index curves, approved by BCFS Research Branch, July 2, 1998;
- Timber Supply Analysis Information Package: TFL 49, Management Plan No. 3, Riverside Forest Products Limited, (prepared by Timberline Forest Inventory Consultants Ltd.), accepted July 3, 1998;
- Timber Supply Analysis Report: TFL 49, Management Plan No. 3, Riverside Forest Products Limited (prepared by Timberline Forest Inventory Consultants Ltd.) accepted July 14, 1998;
- TFL 49, Draft Management Plan No. 3, Riverside Forest Products Limited, submitted July 27, 1998;
- TFL 49, Twenty-Year Plan, Riverside Forest Products Limited, accepted July 10, 1998 (Vernon Forest District) and July 13, 1998 (Penticton Forest District);
- Public input solicited by the licensee regarding the contents of Management Plan No. 3;
- Letter from the Minister of Forests to the Chief Forester, dated July 28, 1994, stating the Crown's economic and social objectives;
- Memorandum from the Minister of Forests to the Chief Forester, dated February 26, 1996, stating the Crown's economic and social objectives regarding visual resources;

- Memorandum from the Deputy Ministers of Forests, and Environment, Lands and Parks, dated August 25, 1997, conveying government's objectives regarding the achievement of acceptable impacts of biodiversity management on timber supply;
- Technical information provided through correspondence and communication among staff from the British Columbia Forest Service (BCFS) and the Ministry of Environment, Lands and Parks (MELP);
- Technical review and evaluation of current operating conditions through comprehensive discussions with BCFS staff, including the AAC determination meeting held in Victoria on October 16, 1998;
- *Forest Practices Code of British Columbia Act*, (as amended);
- *Forest Practices Code of British Columbia Act Regulations*, (as amended);
- *Forest Practices Code of British Columbia* Guidebooks, BCFS and MELP;
- *Forest Practices Code, Timber Supply Analysis*, BCFS and MELP;

Role and limitations of the technical information used

Section 8 of the *Forest Act* requires me as chief forester to consider biophysical as well as social and economic information in AAC determinations. A timber supply analysis, and the inventory and growth and yield data used as inputs to the analysis, typically form the major body of technical information used in AAC determinations. Timber supply analyses and associated inventory information are concerned primarily with biophysical factors—such as the rate of timber growth and definition of the land base considered available for timber harvesting—and with management practices.

However, the analytical techniques used to assess timber supply are simplifications of the real world. There is uncertainty about many of the factors used as inputs to timber supply analysis due in part to variations in physical, biological and social conditions, although ongoing science-based improvements in the understanding of ecological dynamics will help reduce some of this uncertainty.

Furthermore, technical analytical methods such as computer models cannot incorporate all of the social, cultural and economic factors that are relevant when making forest management decisions. Therefore, technical information and analysis do not necessarily provide the complete answer or solution to forest management problems such as AAC determination. The information does, however, provide valuable insight into potential impacts of different resource-use assumptions and actions, and thus forms an important component of the information I must consider in AAC determinations.

In making the AAC determination for TFL 49, I have considered known limitations of the technical information provided, and I am satisfied that the information provides a suitable basis for my determination.

Statutory framework

Section 8 of the *Forest Act* requires the chief forester to consider particular factors in determining AACs for timber supply areas (TSAs) and TFLs. Section 8 is reproduced in full as Appendix 1.

Guiding principles for AAC determinations

Rapid changes in social values and in our understanding and management of complex forest ecosystems mean that there is always some uncertainty in the information used in AAC determinations. Two important ways of dealing with uncertainty are:

(i) minimizing risk, in respect of which in making AAC determinations, I consider the uncertainty associated with the information before me, and attempt to assess the various potential current and future social, economic and environmental risks associated with a range of possible AACs; and

(ii) redetermining AACs frequently, to ensure they incorporate current information and knowledge—a principle that has been recognized in the legislated requirement to redetermine AACs every five years. The adoption of this principle is central to many of the guiding principles that follow.

In considering the various factors that Section 8 of the *Forest Act* requires me to take into account in determining AACs, I attempt to reflect as closely as possible operability and forest management factors that are a reasonable extrapolation from current practices. It is not appropriate to base my decision on unsupported speculation with respect either to factors that could work to increase the timber supply—such as optimistic assumptions about harvesting in unconventional areas, or using unconventional technology, that are not substantiated by demonstrated performance—or to factors that could work to reduce the timber supply, such as integrated resource management objectives beyond those articulated in current planning guidelines or the *Forest Practices Code* (the Code).

The *Forest Practices Code of British Columbia Regulations* were approved by the Lieutenant Governor in Council on April 12, 1995, and released to the public at that time. The *Forest Practices Code of British Columbia Act* was brought into force on June 15, 1995.

Although the Code is now fully implemented following the end of the transition period on June 15, 1997, the timber supply implications of some of its provisions, such as those for landscape-level biodiversity, still remain uncertain, particularly when considered in combination with other

factors. In each AAC determination I take this uncertainty into account to the extent possible in the context of the best available information.

As B.C. progresses toward completion of strategic land use plans, the eventual timber supply impacts associated with the land-use decisions resulting from the various planning processes—including the Commission on Resources and Environment (CORE) process for sub-regional plans, the Protected Areas Strategy or the Land and Resource Management Planning (LRMP) process—are often discussed in relation to current AAC determinations. Since the outcomes of these planning processes are subject to significant uncertainty before formal approval by government, it has been and continues to be my position that in determining AACs it would be inappropriate for me to attempt to speculate on the impacts on timber supply that will eventually result from land-use decisions that have not yet been taken by government. Thus I do not consider the possible impacts of existing or anticipated recommendations made by such planning processes, nor do I attempt to anticipate any action the government could take in response to such recommendations.

Moreover, even where government has made land-use decisions, including Land and Resource Management Plans (LRMPs), it may not always be possible to analyze the full timber supply impact in an AAC determination. In most cases, government's land-use decision must be followed by detailed implementation decisions. For example, a land-use decision may require the establishment of resource management zones and resource management objectives and strategies for these zones. The legislated requirement for five-year AAC reviews will ensure that future determinations address ongoing plan implementation decisions.

Forest Renewal BC is funding a number of intensive silviculture activities that have the potential to affect timber supply, particularly in the long term. As with all components of my determinations, I require sound evidence before accounting for the effects of intensive silviculture on possible harvest levels. Nonetheless, I will consider information on the types and extent of planned and implemented practices as well as relevant scientific, empirical and analytical evidence on the likely magnitude and timing of any timber supply effects of intensive silviculture.

Some have suggested that, given the large uncertainties present with respect to much of the data in AAC determinations, any adjustments in AAC should wait until better data are available. I agree that some data are not complete, but this will always be true where information is constantly evolving and management issues are changing. Moreover, in the past, waiting for improved data created the extensive delays that resulted in the urgency to redetermine all the AACs in the province between 1992 and 1996, many of which were outdated. In any case, the data and models available today are superior to those available in the past, and will undoubtedly provide for more reliable determinations.

Others have suggested that, in view of data uncertainties, I should immediately reduce some AACs in the interest of caution. However, any AAC determination I make must be the result of applying my judgement to the available information, taking any uncertainties into account. Given the large impacts that AAC determinations can have on communities, no responsible AAC determination can be made solely on the basis of a response to uncertainty. Nevertheless, in making my determination, I may need to make allowances for risks that arise because of uncertainty.

With respect to First Nations' issues, I am aware of the Crown's legal obligations resulting from recent court decisions including those in the Supreme Court of Canada. The AAC that I determine should not in any way be construed as limiting those obligations under these decisions, and in this respect it should be noted that my determination does not prescribe a particular plan of harvesting activity within TFL 49.

Overall, in making AAC determinations, I am mindful of my obligation as steward of the forest land of British Columbia, of the mandate of the Ministry of Forests (MOF) as set out in Section 4 of the *Ministry of Forests Act*, and of my responsibilities under the *Forest Practices Code of British Columbia Act*.

The role of the base case

In considering the factors required under Section 8 of the *Forest Act* to be addressed in AAC determinations, I am assisted by timber supply forecasts provided to me through the work of the Timber Supply Review program for TSAs and TFLs. For TFLs, the analysis work is carried out by licensees.

For each AAC determination a timber supply analysis is carried out using an information package including data and information from three categories: land base inventory, timber growth and yield, and management practices. Using this set of data, and a computer model, a series of timber supply forecasts is produced. These include sensitivity analyses to assess the timber supply effects of uncertainties or changes in various assumptions around a baseline option, normally referred to as the "base case" forecast.

The base case forecast may incorporate information about which there is some uncertainty. Its validity—as with all the other forecasts provided—depends on the validity of the data and assumptions incorporated into the computer model used to generate it. Therefore, much of what follows in the considerations outlined below is an examination of the degree to which all the assumptions made in generating the base case forecast are realistic and current, and the degree to which its predictions of timber supply must be adjusted, if necessary, to more properly reflect the current situation.

These adjustments are made on the basis of informed judgement, using current information available about forest management, which may well have changed since the original information package was assembled. Forest management data is particularly subject to change during

periods of legislative or regulatory change, such as the enactment of the *Forest Practices Code*, or during the implementation of new policies, procedures, guidelines or plans.

Thus it is important to remember, in reviewing the considerations which lead to the AAC determination, that while the timber supply analysis with which I am provided is integral to those considerations, the AAC determination itself is not a calculation but a synthesis of judgement and analysis in which numerous risks and uncertainties are weighed. Depending upon the outcome of these considerations, the AAC determined may or may not coincide with the base case forecast. Judgements that may in part be based on uncertain information are essentially qualitative in nature and, as such, subject to an element of risk. Consequently, once an AAC has been determined, no additional precision or validation may be gained by attempting a computer analysis of the combined considerations to confirm the exact AAC determined.

Timber Supply Analysis

The timber supply analysis for TFL 49 was conducted by Timberline Forest Inventory Consultants Limited (Timberline) on behalf of Riverside Forest Products Ltd. Timberline used its proprietary computer simulation model called Continuous Area Simulation of Harvesting and Forest Management (CASH-FM version 5) to conduct the analysis. Based on previous experience examining results from this model, I am satisfied that it is capable of providing a reasonable projection of timber supply.

The timber supply analysis examined harvest forecast options using three different assumptions for land base. These included a "current management option"; an "Okanagan TSA integrated resource management (IRM) timber harvesting guidelines option"; and a "Riverside management option". The current management option closely models current management practices on areas accessible using accepted harvesting technologies on TFL 49, and therefore represents the base case (as discussed above under "The role of the base case").

For TFL 49, the base case projected an initial harvest rate of 380 000 cubic metres per year for two decades, followed by a decline of ten percent per decade for six decades to 213 167 cubic metres per year in decade eight. The projected harvest flow then rises in decade ten to reach a long-term level of 290 000 cubic metres per year.

Key factors affecting the base case harvest projection include the current age class structure of stands on the TFL; the productivity of the TFL 49 land base; the distribution of areas that do not contribute to timber supply; and, the availability of managed stands for harvest particularly during decades seven and eight.

In the timber supply analysis, sensitivity analyses were provided to assess the risk to timber supply resulting from uncertainty in data assumptions and estimates, and these have assisted me in considering the factors leading to my determination.

Consideration of Factors as Required by Section 8 of the *Forest Act*

Section 8 (7)

In determining an allowable annual cut under this section the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

(a) the rate of timber production that may be sustained on the area, taking into account

(i) the composition of the forest and its expected rate of growth on the area

Land base contributing to timber harvest

- general comments

The total area of TFL 49 as reported in the timber supply analysis is 143 760 hectares. As part of the process used to derive the timber harvesting land base—i.e., the land base estimated to be economically and biologically available for harvesting—a series of deductions was made from the productive forest land base. These deductions account for factors which operate to reduce the forest area available for harvesting for economic or ecological reasons. In timber supply analysis, assumptions, and if necessary, projections, must be made about these factors prior to quantifying appropriate areas to be deducted from the productive forest area in order to derive the timber harvesting land base. These factors are described in detail below.

In reviewing these deductions I am also aware that some areas may have more than one classification—e.g. environmentally sensitive areas (ESAs) may also lie within riparian areas. To ensure the accuracy of the timber harvesting land base calculation, it is imperative that no deduction be made more than once in respect of the same area of land, by virtue of it or of some part of it coming under more than one classification. Hence, a specific deduction for a given factor reported in the analysis or the AAC rationale does not necessarily reflect the total area with that classification; some portion of it may have been deducted earlier under another classification. For TFL 49 I acknowledge that the above approach was used in the licensee's timber supply analysis to appropriately determine the timber harvesting land base and find the results to be reasonable.

- non-forest, non-productive areas and non-commercial cover

Non-forested areas on TFL 49 include alpine areas, rock and lakes, agricultural land, main roads and provincial highways. The licensee deducted 8 337 hectares from the total TFL 49 land base to account for non-forested areas. Standard procedures were followed in the analysis to exclude these areas. The licensee also identified 92 hectares of non-commercial cover (brush) and appropriately deducted them from the productive land base.

- physical operability

Terrain characteristics and access typically affect the areas on which the licensee may potentially conduct harvesting operations. Harvesting methods employed by the licensee include conventional skidder and cable yarding systems as well as helicopters. Except for areas that are unavailable for harvesting to protect resources other than timber (e.g., environmentally sensitive areas, recreation reserves), and areas where timber quality renders it uneconomic to harvest, all areas on TFL 49 are accessible using the harvest methods employed by Riverside.

Having reviewed the criteria and assumptions used by the licensee to assess physical operability for the land base, I am satisfied this factor has been modelled appropriately and is suitable for this determination. Any information resulting from new studies can be incorporated into future timber supply analyses.

- steep slopes

TFL 49 comprises 5488 hectares of mature forest on slopes greater than 50 percent and 2891 hectares on slopes greater than 60 percent. The licensee considers all these areas to be available for harvest and has made no reduction on this account.

For the purposes of this determination I accept this assumption noting that the licensee commits to harvesting at least five percent of harvested volume on these slopes to approximately reflect the slope profile of the TFL.

- environmentally sensitive areas (ESAs)

Based on the licensee's resource inventories, 1837 hectares of ESAs were deducted from the productive forest land base in the analysis. These deductions account for the protection of sensitive or unstable soils, wildlife habitat and also to account for difficult-to-regenerate areas.

BCFS District staff concur with the location and extent of the deductions for ESAs. Specific details of each ESA category are considered later in the section entitled, Integrated Resource Management Objectives.

- non-merchantable stands

In the timber supply analysis, Riverside excluded 6767 hectares from the timber harvesting land base to account for deciduous, low volume and low productivity stands which are uneconomical to harvest. The licensee used a combination of leading species, site index or volume limits, diameter class and age criteria to assess merchantability.

I have reviewed the criteria used by the licensee to determine unmerchantable stands and note that a significant proportion of low volume stands are included in the timber harvesting land base. However, the standards applied are supported by the licensee's current operational practices and I therefore accept the assumptions and area deducted for unmerchantable stands for use in this determination.

- estimates for roads, trails and landings

To account for *existing* roads, trails and landings, the licensee excluded 2656 hectares from contributing to the timber harvesting land base. This area is equivalent to approximately 2.2 percent of the timber harvesting land base.

In estimating this deduction this licensee considered two separate components. Firstly, roads and highways that were wide enough to be identified as distinct areas in the TFL 49 inventory totalled 848 hectares. These areas were excluded from the timber harvesting land base as part of the non-forest deductions described above under *non-forest and non-productive areas.*

The second component involves roads and trails that are represented as line features in the forest cover inventory. Using computer mapping (GIS) techniques, the licensee estimated 1537 hectares of existing roads and trails and deducted them in deriving the timber harvesting land base. To account for landings, the licensee deducted an additional 271 hectares based on the assumption that on average each landing occupies 0.2 hectares.

In a subsequent review of roads, trails and landings, Riverside and BCFS District staff determined that the assumptions used in the analysis did not fully account for all productive areas lost to roads and trails. The area not regenerated to productive forest that occurs adjacent to roads was not included in the road widths leading to an underestimation in existing road widths of from three to ten metres. While the corresponding area of these revised road widths is uncertain, I find it likely that timber supply over the forecast period is overestimated by less than one percent compared to the base case harvest projection.

In addition, some existing trails were incorrectly assigned a six-metre buffer rather than a three-metre buffer. BCFS staff and the licensee subsequently determined that the associated area of existing trails on TFL 49 was overestimated by approximately 108 hectares. For timber supply analysis purposes this overestimate represents an insignificant proportion of the timber harvesting land base and has a negligible impact on the base case harvest forecast.

To account for *future* roads, trails and landings, the licensee assumed that a similar two percent deduction would be required based on the supposition that future road development is likely to occur at approximately the same intensity as existing roads. In the timber supply analysis, Riverside therefore permanently removed two percent of each simulated harvest area to account for future roads, trails and landings. The total area excluded from contributing to the timber harvesting land base was 986 hectares. This reduction was applied to stands over 40 years old and the licensee assumed the TFL would be fully developed with roads in 40 years.

Subsequent to the analysis, BCFS staff and the licensee re-examined the methodology used to estimate future roads, trails and landings. Using a more appropriate approach, they indicated that the deduction for future roads, trails and landings was underestimated by approximately 215 hectares (approximately 0.2 percent of the timber harvesting land base).

In conclusion, I find that the assumptions applied in the timber supply analysis for *existing* roads, trails and landings overestimate the base case timber supply by less than one percent. In reviewing the concerns raised regarding *future* roads reductions, I conclude that timber supply is overestimated by approximately 0.2 percent compared to the base case harvest projection. I have taken the combined impact of these overestimates (less than 1.2 percent) and their associated uncertainties into account in making my determination as described below under Reasons for decision. I request that the licensee re-examine these estimates—for both current and future roads, trails and landings—in time for the next determination.

Existing forest cover inventory

- general comments

The most recent forest cover inventory of TFL 49 was completed in 1996 to Vegetation Resources Inventory (VRI) Phase I standards. This inventory information was updated for depletions and growth to January 1, 1996 for use in the timber supply analysis.

Phase II VRI sampling completed on the licence area was compiled and used by BCFS Resources Inventory Branch staff to audit the overall accuracy of the volume projection estimates for the TFL. The results of this assessment suggest that coniferous stand volumes projected from the inventory file may be underestimated by up to 15 percent for stands older than 60 years. Although this assessment strongly suggests the inventory volumes are underestimated, it does not provide me with the statistical basis to apply these results directly to the timber supply analysis. The assessment provides generalized results which are statistically reliable for the entire TFL, but does not identify the accuracy of the volume estimates in the inventory data for a particular part or parts of, or for particular groups, species or site classes within the TFL. Nevertheless, I find it likely that the base case timber supply is more favorable than depicted in the base case harvest flow.

A sensitivity analysis provided by the licensee showed that increasing existing stand volumes by 15 percent significantly increases timber supply in the medium term compared to the base case. The initial harvest level can also be maintained for an additional two decades before declining. I have considered the above information and the related uncertainty in my Reasons for decision.

- age-class distribution

Approximately two percent of the timber harvesting land base is covered by stands more than 250 years old, 26 percent by stands between 140 and 250 years old, 47 percent by stands between 60 and 140 years old and 25 percent by stands less than 60 years old. Stands currently between 40 and 70 years old represent only six percent of the timber harvesting land base and limit the available timber supply of TFL 49 in the medium term.

- species profile

The TFL 49 timber harvesting land base consists of stands comprised primarily of lodgepole pine, Douglas-fir, spruce, and balsam. Approximately 43 percent of the timber harvesting land base is covered by lodgepole pine-leading stands. Douglas-fir-, spruce- and balsam-leading stands comprise a further 29 percent, 15 percent, and 13 percent respectively.

- volume estimates for existing stands

Volume estimates for existing stands were derived using the Variable Density Yield Projection (VDYP) model. VDYP is based on information gathered from a large number of sample plots throughout the province, and is generally accepted in B.C. as an adequate model for projecting volumes in existing natural stands. As a general rule in making AAC determinations, and in the absence of statistically valid contradictory evidence for a particular area, I rely on VDYP to project the volume of existing stands. In the timber supply analysis for TFL 49, the licensee followed recognized procedures, and I therefore accept the estimates used for use in this determination.

Expected rate of growth

- site productivity estimates

Inventory data includes estimates of site productivity for each forest stand, expressed in terms of a site index. For a given forest stand, the site index is based on the height of the stand as a function of its age. The productivity of a site largely determines how quickly the trees on it will grow, and therefore affects the time seedlings will take to reach green-up conditions, as well as the volumes of timber that will grow, and the age at which a stand will satisfy mature forest cover requirements and reach a merchantable size or a minimum harvestable age.

In general, forest stands between 30 and 140 years of age provide the most accurate measurement of site productivity. Site indices determined from younger stands, and older stands that may not accurately reflect potential site productivity. In young stands, growth often depends as much on recent weather, stocking density and competition from other vegetation as it does site quality. In old stands, which have not been subject to management of stocking density, the trees used to measure site productivity may have grown under intense competition or may have been damaged, and therefore may not reflect the true growing potential of the site. This has been verified in several areas of the province where studies—known as the old-growth site index (OGSI) project—suggest that actual site indices may be higher than those indicated by existing data from mature forests.

TFL 49 is composed of three administrative blocks: blocks A, B, and C. In deriving the base case harvest projection, the licensee used standard BCFS site curves to assign site indexes for stands older than 30 years, except for those stands older than 140 years in block B. For those stands on block B, the licensee applied ecological site association mapping to adjust the site index values of stands older than 140 years upon regeneration. Stands in blocks A and C were not similarly adjusted because no site association mapping was available for these blocks.

Stands with the same leading species were then grouped by age (less than 140 years and greater than 140 years) and assigned to one of three productivity classes. The licensee then derived area-weighted average site indexes for each of these groups in order to generate yield tables.

The licensee provided a sensitivity analysis to demonstrate the impact on timber supply of applying general provincial OGSI adjustment equations to the older stands in blocks A and C. Application of these adjustments increased timber supply in the medium- and long-term by 23 percent and 12 percent respectively when compared to the base case harvest forecast.

I have reviewed the site index assignments for TFL 49 and have considered the likelihood that site productivity may be significantly underestimated in blocks A and C in my Reasons for decision. I acknowledge the licensee's use of site association mapping and encourage the licensee to further refine the estimates of site productivity, particularly on blocks A and C, before the next analysis.

- aggregation procedures

For the timber supply analysis, the inventory for TFL 49 was aggregated into 36 analysis units based on inventory type group (leading species), productivity class, age and location. Existing and managed stand yields were generated for each of these analysis units. I have reviewed the approach used and consider the licensee's analysis unit definitions and aggregation procedures to be acceptable for use in this determination. I note the licensee's analysis units are quite detailed and effectively capture the productivity of this unit.

- volume estimates for regenerated stands

Volume estimates for regenerated stands were derived using the Table Interpolation Program for Stand Yields (batch TIPSY version 1.0) growth and yield model. This computer program was developed by the BCFS and is generally accepted in B.C. as an appropriate model for projecting yields from managed stands.

In the timber supply analysis, all existing natural stands less than 30 years old—both of planted and natural origin—are assumed to be managed. All future regenerated stands except pine are assumed to be planted. Fifty-two percent of pine-leading stands are assumed to be planted—the balance are assumed to regenerate naturally. Initial stocking for all species, both planted and natural was assumed to be 1400 stems per hectare. BCFS Research Branch staff reviewed and approved all managed stand yield tables used in the analysis.

Riverside provided a sensitivity analysis to demonstrate the impact on timber supply of increasing and decreasing regenerated stand yields by ten percent. The results indicated a 12 percent increase and ten percent decrease respectively to the long-term base case harvest projection. While long-term timber supply is sensitive to uncertainties in regenerated stand yields, the sensitivity analysis showed there was no short- or medium-term impact compared to the base case harvest projection.

Having reviewed the assumptions used in the base case as well as the associated sensitivity analysis, I am satisfied that the estimates of regenerated stand volumes appropriately represent past and likely future management. I therefore find them acceptable for use in this determination.

- operational adjustment factors (OAFs)

To account for the loss of timber volume due to operational conditions, the licensee applied Operational Adjustment Factors (OAFs) to the yield projections for regenerated stands used in the timber supply analysis. Riverside applied a ten percent OAF for unmapped stand openings (OAF 1) and a five percent OAF to account for decay and age-related losses such as waste and breakage during harvest (OAF 2).

While the OAF 1 used is lower than values applied in other units, the licensee indicates that the reduction factor is appropriate because the recent vegetation inventory provides better resolution and mapping of non-productive areas. BCFS Research Branch staff have reviewed the licensee's OAFs and consider the evidence provided justifies a small reduction to the standard 15 percent OAF 1. I agree with their assessment noting the precise magnitude of this reduction is uncertain and requires further investigation. However for the purposes of this determination, and in the absence of better information, I accept the licensee's assumptions regarding OAFs. I also request that the licensee further examine and refine the OAFs before the next analysis.

- *minimum harvestable ages*

Minimum harvestable age is an estimate of the earliest age at which a stand has grown to a harvestable condition. Changing the minimum harvestable age generally affects when second growth stands will be available for harvest and, accordingly, how quickly existing stands may be harvested. In practice, many forest stands will be harvested at much older ages than the minimum, due to constraints on harvesting which arise from managing for other forest values such as visual quality, wildlife and water quality.

In the TFL 49 timber supply analysis, minimum harvestable ages of stands were based on culmination age. Culmination age ranged from 70 to 140 years for existing natural stands, and from 50 to 140 years for managed stands. Stand volumes at culmination age ranged from 89 cubic metres to 296 cubic metres per hectare for existing stands and 148 cubic metres to 438 cubic metres per hectare for regenerated stands.

The licensee performed a sensitivity analysis to show the impact on timber supply of varying minimum harvestable age. The results showed that reducing the minimum harvestable age by ten percent significantly increases timber supply in the medium term because more timber is available during the period when the availability of culminated stands limits harvest flow.

Predicting the age at which stands may be harvested in the future is difficult and subject to considerable uncertainty. While I note that many of the stands on TFL 49 will culminate at a volume less than 100 cubic meters per hectare I acknowledge that Riverside has successfully demonstrated performance in stands of comparable volume. Having considered the age and volume criteria which were applied in the analysis, I accept the minimum harvestable ages modelled in the base case as satisfactory for use in this determination.

Harvest profile

The licensee did not assume stands would be harvested according to a specific species profile in the base case timber supply. In the model, age was used to select stands for harvest; relative oldest stands were harvested first.

Although no explicit consideration was given to modelling species profile in the analysis, I note that the assumptions used in effect simulate a harvest which closely approximates the current species profile of older stands on TFL 49. As a result, and with no better information, I find the method used to model the harvest profile acceptable for use in this determination.

(ii) the expected time that it will take the forest to become re-established on the area following denudation:

Regeneration delay

Regeneration delay is the period between harvesting and the time at which an area becomes occupied by a specified minimum number of acceptable, well-spaced seedlings. In the timber supply analysis, the licensee assigned a regeneration delay of four years to regenerating Douglas-fir and natural pine stands and a three year delay for all other species. BCFS District staff have reviewed the regeneration delays used and find them to adequately represent current practice. Having reviewed the assumptions used in the analysis, I accept the estimates of regeneration delay as suitable for this determination.

Not-satisfactorily-restocked areas

Not-satisfactorily-restocked (NSR) areas consist of productive forest land that has been denuded and has failed, partially or completely, to regenerate either naturally or by planting or seeding to the specified or desired "free growing" standards for the site.

On TFL 49 there are approximately 3806 hectares of NSR area within the timber harvesting land base. In the timber supply analysis, Riverside incorrectly assumed that the NSR area would be evenly distributed across the full range of ages in age class 1 (1-10 years). In addition, no regeneration delay was assumed in the yield estimates for existing stands and as a result, in the model NSR areas will be scheduled for harvest earlier than in practice. Green-up ages will also be misrepresented.

I have reviewed the assumptions and conclude that the modelling technique used to account for NSR areas likely overestimates the base case timber supply in the short- and medium-terms, by a small but unquantified amount and have discussed this below in my Reasons for decision. Before the next determination, I request the licensee review the modelling assumptions to provide a more accurate accounting of NSR areas.

Impediments to prompt regeneration

The licensee's ESA inventory identified 486 hectares of areas where stand regeneration would be difficult to re-establish. These areas were appropriately removed from the timber harvesting land base. I have no reason to disagree with the assumptions provided, and accept that this factor has been accounted for appropriately.

(iii) silvicultural treatments to be applied to the area:

Silvicultural systems

The predominant silvicultural system currently in use on TFL 49 is clearcutting. According to the licensee, partial cutting systems account for approximately five percent of the total volume harvested annually and are presently employed on the driest sites of the TFL.

In the timber supply analysis, TFL 49 was modelled as being clearcut with no specific accounting made for the small area that is currently harvested using partial cutting systems. Riverside provided a sensitivity analysis to simulate the effect of using partial cutting systems on the base case timber supply projection. The analysis showed a five percent decrease in long-term timber supply with no impact in the short- and medium- term harvest flow.

I acknowledge that, while methods to more accurately reflect partial cutting systems in growth and yield models and timber supply analyses are currently being developed, there is still considerable uncertainty with the methods used to model these systems. Due to the relatively small area that is currently harvested using systems other than clearcutting, I am satisfied that the approach used by the licensee provides a reasonable simulation of current practice. Having reviewed the information including the associated sensitivity analysis, I note a small unquantified downward impact on timber supply due to this factor and have discussed this below in my Reasons for decision. I request the licensee provide more explicit modelling of silvicultural systems in time for the next determination.

Silvicultural treatments

Basic silviculture on TFL 49 includes site preparation, planting of suitable species, and treatments to ensure that regenerated areas achieve free-growing status within a specified period. In the base case analysis, existing stands were regenerated to preferred species combinations assigned by the licensee. Initial stocking densities were modelled at 1400 stems per hectare for all species.

BCFS District staff have reviewed the licensee's regeneration assumptions and observe that operationally, balsam stands do not generally regenerate entirely to spruce stands as was modelled in the base case timber supply analysis. While yields from managed spruce and balsam stands on the same site are generally comparable, I note that in the TFL 49 base case, regenerated spruce yields incorporate genetic gains of seven percent.

No such gains are yet available for balsam. Therefore if regeneration of existing balsam stands includes a significant balsam component—as is likely on TFL 49—the base case harvest forecast will be reduced in the long term by a small (less than one percent) but uncertain amount.

BCFS District and BC Environment staff advise that because of ungulate winter range requirements, Douglas-fir stands should not be regenerated to stands consisting of 90 percent lodgepole pine and 10 percent Douglas-fir, as was assumed in the base case. The licensee also indicates that operationally Douglas-fir stands are regenerated to 50 percent Douglas-fir and 50 percent lodgepole pine to address root rot concerns.

I also note that on these sites, interior lodgepole pine yields are substantially higher than interior Douglas-fir stand yields and culmination age is 30 to 40 years less for pine stands. Therefore, if Douglas-fir stands are harvested and subsequently regenerated with a higher component of Douglas-fir than was modelled in the base case, I estimate the long-term base case harvest level may be reduced by up to five percent with an uncertain but potentially negative impact on the medium-term harvest flow.

In summary, I note that the regeneration assumptions employed by the licensee do not entirely reflect operational practice. While the precise impact on timber supply due to uncertainties regarding appropriate species combinations used to regenerate balsam and Douglas-fir stands is unknown, I acknowledge that the base case timber supply may be overestimated by up to six percent, and have discussed this below under Reasons for decision. I request the licensee clarify the regeneration regimes for TFL 49 in time for the next analysis.

Intensive silviculture

Intensive silviculture activities include commercial thinning, juvenile spacing, pruning, fertilization, and genetic improvement. I will discuss these treatments below under their appropriate sections.

With the exception of genetic improvement (described below), intensive silviculture is practiced to a limited extent on TFL 49. I acknowledge the licensee's interest in exploring the potential for increasing timber supply by applying more intensive silvicultural treatments. While these activities may provide an opportunity to increase timber supply, without a comprehensive strategy or proven application of these activities on the TFL, I cannot account for any potential increase in timber supply in this determination. If and when these potential treatments become current practice, their implications will be assessed in future AAC determinations.

- genetic improvement

Genetically-improved planting stock for many commercial tree species is currently being used across the province. The aim of tree improvement is to breed trees with increased growth rates, improved wood properties and greater resistance to insect pests and diseases. On TFL 49 the licensee uses a significant amount of improved interior spruce seed for reforestation and has committed to further increase its use in future reforestation plans.

To account for the use of improved seed, Riverside increased the site index of those stands planted with spruce and pine based on their year of establishment. Site index increases of between two percent (spruce planted from 1992 to 1997) and 5.5 percent (genetically-improved pine planted after 1998) were used in the analysis. BCFS Research Branch has reviewed the site index assignments for genetically improved regeneration and agree they approximate the intended volume gains.

I acknowledge the licensee's commitment to expanding the use of genetically improved seed and am satisfied that the assumptions used in the timber supply analysis reflect current practice, and therefore accept them for use in this determination.

- fertilization

No areas of TFL 49 have been fertilized and currently no areas are planned for treatment. Therefore the licensee did not account for fertilization in the timber supply analysis. If and when any fertilization treatments are planned and implemented operationally, I will consider the associated impacts in future AAC determinations.

- juvenile spacing

Between 1980 and 1996, an average of 460 hectares per year was juvenile spaced on TFL 49. For the analysis, Riverside assumed that the stocking standards used in developing yield projections for regenerated stands adequately reflect expected yields for spaced stands. I am satisfied that the spacing assumptions used in the timber supply analysis reflect current practice, and therefore accept them for use in this determination.

I also acknowledge Riverside's initiative in developing an Enhanced Forest Management Pilot Project and will consider the effects on timber supply of any related intensive silviculture treatments including juvenile spacing in future determinations.

- commercial thinning

Commercial thinning is the harvesting, in a maturing stand, of trees large enough to be considered a commercial product. While I note that single-entry commercial thinning regimes do not generally increase the yield of specific stands, they can provide opportunities to harvest timber in areas where harvesting must be limited to meet a variety of other resource objectives.

I acknowledge that the licensee is investigating opportunities for commercial thinning in selected stands. However, no commercial thinning operations have been completed to date and none is planned for the duration of MP No. 3.

Commercial thinning was therefore appropriately not modelled in the timber supply analysis. I acknowledge that the timber supply analysis reflects current operational practice and thus have made no associated adjustment to the base case harvest projection for this determination.

- stand conversion

In the timber supply analysis 3854 hectares of young aspen stands on TFL 49 were not included in the base case harvest forecast. Riverside currently has no plans to harvest aspen. However, as these stands age they may naturally succeed to conifer species and be available for harvest in the future. To simulate the potential impact of this succession on future timber supply, the licensee provided a sensitivity analysis which assumed these stands would revert to conifer species by age 150 years. The licensee also assumed that 978 hectares of overstocked lodgepole pine stands would be harvested and adequately regenerated in 50 years. The analysis showed that converting these sites to productive conifer stands increases long-term timber supply by 1.7 percent over the base case harvest forecast.

I note that accurate growth and yield information on the dynamics of deciduous and overstocked stands is currently very limited. However, management practices aimed at successfully converting these areas into commercial tree species present an opportunity to increase the timber harvesting land base and future timber supplies. However, no specific stand conversion treatments have been demonstrated to date. If and when these treatments are proven operationally, I will consider the associated timber supply impacts in future determinations.

(iv) the standard of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area:

Utilization standards

Utilization standards define the species, dimensions and quality of trees that must be harvested and removed from an area during harvesting operations. These standards were incorporated into the timber supply analysis for TFL 49 to estimate minimum merchantable stand volume.

For all species harvested on TFL 49, the utilization standards used in the analysis were a 12.5 centimetre minimum diameter-at-breast-height (dbh) with a 30-centimetre stump height and 10-centimetre top-diameter-inside-bark. BCFS District staff confirm that the 12.5 centimetre minimum dbh reflects operational practice on TFL 49 but note that the corresponding interior utilization standard for species other than pine is a 17.5 centimetre dbh.

In addition, the licensee maintains that the current practice on TFL 49 result in a 20-centimetre stump height, not the 30-centimeter stump height used in the analysis. BCFS District staff agree that, except in areas where snow pack makes a 20-centimetre stump height difficult to achieve, Riverside harvests stands to a 20-centimeter stump height.

I acknowledge that the utilization standards regarding the minimum dbh used in the timber supply analysis reasonably reflect current practice. Reducing stump heights increases the volume of timber recovered and increases the base case timber supply by a small but uncertain amount.

For this determination, I am prepared to accept that stump heights have been conservatively modelled and may work to increase the base case timber supply over the forecast period by less than one percent. I have discussed this below in my Reasons for decision. I request that the licensee develop a more refined method to account for lower stump heights on TFL 49 before the next analysis.

Decay, waste and breakage

To account for decay, waste and breakage, the licensee generated yield tables using local data from Okanagan special cruise factors #187 for Douglas-fir, cedar and hemlock. Loss factors for Forest Inventory Zone D were used for all other species. This approach was reviewed and accepted for use in the timber supply analysis by BCFS Resources Inventory Branch staff.

I consider the estimates for decay, waste and breakage used in the timber supply analysis to reflect the best available information and suitable for use in this determination.

(v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production:

Integrated resource management objectives

The Ministry of Forests is required under the *Ministry of Forests Act* to manage, protect and conserve the forest and range resources of the Crown and to plan the use of these resources so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated. Accordingly, the extent to which integrated resource management (IRM) objectives for various forest resources and values affect timber supply must be considered in AAC determinations.

- non-timber resource inventories and assessments

From 1991 to 1997, inventories for environmentally sensitive areas (ESAs), recreation resources, landscape, wildlife and riparian resources, have been conducted or updated. Ecological mapping on block B of TFL 49 was completed in 1982. These inventories—reviewed and approved by Kamloops Forest Region staff—were used to develop data assumptions for the timber supply analysis as further discussed below under the appropriate sections.

- sensitive soils

Riverside identified 5798 hectares of areas with highly and moderately sensitive soils on the TFL based on the 1991 ESA inventory. Only areas with highly sensitive soils—a total of 1546 hectares—were excluded from the timber harvesting land base. BCFS staff agree with the licensee's assumptions and accounting for sensitive soils.

Having reviewed the information, I find that the assumptions used to account for sensitive soils suitably reflect current practices and are appropriate for this determination.

- archaeological sites

An Archaeological Overview Assessment was conducted in the Okanagan Timber Supply area. A single culturally modified tree was identified within the Vernon Forest District. I am advised that no reserve area was required to protect this site.

At this time I have no information to suggest whether, or to what extent, the timber supply in TFL 49 may be affected by archaeological or historical values. To date no areas on TFL 49 have been identified as requiring protection for cultural heritage or archaeological resources. However, additional assessments may be completed before the next timber supply analysis. If the results of these assessments indicate a need to exclude areas from the timber harvesting land base, the impact on timber supply will be considered in future AAC determinations.

- recreation

TFL 49 provides various recreational opportunities including boating, camping, hiking and fishing. A total of 540 hectares of recreation reserves, designated to provide long-term public access (mainly around lakes) was excluded from the timber harvesting land base. For the purposes of this determination I am satisfied that the licensee has used the best available information and has adequately accounted for recreation concerns.

- wildlife habitat

TFL 49 supports many large mammal species including moose, mule deer, and black bear and as well as various birds, reptiles, amphibians and invertebrate species. Areas having critical importance to wildlife are identified in the licensee's current ESA inventory. This ESA inventory

identifies approximately 1422 hectares of areas having high wildlife values (Ew1) and 13 291 hectares of areas having moderate wildlife values (Ew2).

None of these areas was removed from the timber harvesting land base to specifically account for wildlife values. Instead, forest cover requirements were applied to 17 746 hectares of ungulate winter range on TFL 49 identified in the *Canada Land Inventory of Wildlife Habitat* (CLI). The licensee contends that there is a strong correlation between the boundaries of the wildlife ESAs and those identified as ungulate winter range areas in the CLI. BC Environment staff agree that the areas are geographically similar and find the comparison appropriate for timber supply analysis purposes.

Consistent with the Forest Practices Code *Operational Planning Regulation*, the Vernon and Penticton District Managers, as well as the designated environment officials have collectively established management objectives for the ungulate winter range areas on TFL 49. To simulate these objectives in the timber supply analysis, the licensee applied forest cover requirements based on the *Okanagan IRM Timber Harvesting Guidelines*. In the base case a maximum of 20 percent of the productive area was permitted to support stands less than three metres tall and a minimum of 40 percent of the productive area was required to support stands older than age 90. BCFS District and BC Environment staff have reviewed the approach used and agree that the licensee used an acceptable method to model ungulate winter range.

Having reviewed the criteria and assumptions used in the analysis, I accept the information regarding ungulate winter range as modelled and have made no further adjustments. I note that in conjunction with BCFS and BC Environment staff, the licensee will be reviewing and updating ungulate winter range areas by October 15, 2003, as required by the *Operational Planning Regulation* of the Forest Practices Code. Any new information can be incorporated into subsequent timber supply analyses.

TFL 49 may also provide habitat to red- and blue-listed (identified) wildlife species including the Northern Goshawk. To date no nesting sites have been found nor were any red- or blue listed wildlife species (including goshawks) explicitly modelled in the timber supply analysis. Should new information be provided on goshawks or other identified wildlife species, including their potential impacts on timber supply of a provincial wildlife strategy, this can be incorporated into future timber supply analyses.

- riparian habitat

Riparian habitats occur along the streams and around lakes and wetlands. The *Forest Practices Code* requires the establishment of riparian reserve zones (RRZs) that exclude timber harvesting, and riparian management zones (RMZs) that restrict timber harvesting in order to protect riparian and aquatic habitats. Stream riparian classes are designated S1 to S6 depending on the presence of fish, stream channel width, and presence of community watersheds.

For TFL 49 riparian areas were classified based on field surveys in addition to local knowledge, and then incorporated into the licensee's Geographic Information Systems (GIS) database. Insufficient detail was available to precisely classify all streams. Approximately 5226 kilometers of unclassified streams identified in the inventory—mainly smaller higher order streams—were therefore assigned to the S6 stream category for the purposes of the analysis.

Using GIS-based techniques, and widths specified in the *Riparian Management Area Guidebook*, the licensee created riparian buffers adjacent to the streams, lakes and wetlands to approximate the area in RRZs on TFL 49. To account for the corresponding RMZs, the licensee developed a forest cover requirement for the total riparian management zone by area-weighting the maximum retention levels for each stream class as established in the *Riparian Management Area Guidebook*. Using this method, the licensee derived an overall minimum retention level (16 percent) for stands older than age 100 and applied this to the RMZs in the analysis.

The accepted process for assessing lake shore management zones and appropriate forest management activities near lakes is detailed in the *Lake Classification and Lakeshore Management Guidebook, Kamloops Forest Region*. This guidebook was adopted after completion of the timber supply analysis and as a result, BCFS District staff estimate that approximately 424 hectares of lakeshore reserves and 3100 hectares of lakeshore management zones were not accounted for in the timber supply analysis.

I have reviewed the above information and note that a high proportion of streams (approximately 88 percent) are unclassified. While many of these unclassified streams may be S6 streams, based on my knowledge of similar terrain, I find it likely that some of the unclassified streams (defaulted to S6) are in fact S4 streams. However, the licensee has used the best available information and has identified this as an information deficiency.

I conclude that the implications of not fully accounting for lakeshore management areas acts to reduce the base case timber supply by less than one percent and have discussed this below in my Reasons for decision. I note that regardless of the assumptions made for the analysis, the licensee will still be required to meet the standards of the *Forest Practices Code*. Notwithstanding this requirement, I expect the licensee to thoroughly review the riparian inventory and classification before the next timber supply analysis and AAC determination.

- green-up and adjacency

Green-up time refers to the period following harvesting necessary for a regenerating stand to attain a specified height and stocking. Current harvesting practices limit the size and shape of cutblocks, and establish minimum green-up conditions as a means of moderating the effect of additional harvesting in adjacent stands. Adjacency and green-up requirements provide for a distribution of harvested areas and retention of forest cover in a variety of age classes across the landscape.

In the TFL 49 base case, the licensee used a green-up height of three metres in the integrated resources management (IRM) zone. The licensee assumed that at any time, no more than 33 percent of the productive land base may consist of stands of trees less than three metres tall. Although the constraint was applied to the productive land base rather than the timber harvesting land base, the methodology used is typical of many timber supply analyses. Detailed examination of analysis results showed that throughout the planning horizon, disturbance levels rarely exceeded ten percent, well below the maximum permitted disturbance. This indicates that the constraint applied would also be met on the timber harvesting land base.

Riverside provided a sensitivity analysis which showed that timber supply on TFL 49 is not greatly affected by changes in green-up height requirements. Relaxing the green-up height requirement in the IRM zone from three metres to two metres does not impact the base case harvest forecast.

Having reviewed the above information, I accept the licensee's base case projection as suitable for this determination, noting that what was modelled reflects current practice on the TFL.

- *watershed considerations*

TFL 49 contains several community watersheds where the protection of water quality and quantity is of primary concern. The Lambly, Powers, Norris, Hope and Silver Creek watersheds comprise 18 673 hectares—approximately 15 percent of the TFL area. These watersheds are designated as community watersheds under the *Forest Practices Code*.

In the base case the licensee included these community watersheds in the general IRM zone; there was no explicit modelling for community watersheds. BCFS hydrologists suggest that stands averaging three metres—the height modelled in the base case—are unlikely to provide the conditions required to achieve water quality and quantity objectives in community watersheds.

Riverside provided a sensitivity analysis to show the impact of applying forest cover requirements comparable to those used in the adjacent Okanagan TSA analysis to areas designated as community watersheds. The requirements allowed 20 percent of the productive area within community watersheds to be covered by stands of trees less than six metres in height. The results of the sensitivity analysis indicate that these more restrictive forest cover requirements reduce timber supply in the medium-term compared to the base case forecast.

I acknowledge that the *Forest Practices Code* requires the assessment of community watersheds to establish their susceptibility to adverse effects on water values due to forest practices. I note the licensee has committed to undertake or complete watershed assessments consistent with the *Interior Watershed Assessment Procedures Guidebook*. I also note that the local water advisory committee is currently reviewing forest management activities within watersheds in cooperation with the licensee. I will take the results of these assessments into account in future determinations.

In summary, I have reviewed the information on watershed considerations and find that the appropriate management regime within the community watersheds may be more restrictive to timber harvesting in the future. Moreover, the licensee's sensitivity analysis suggests that more restrictive forest cover requirements will have a significant downward impact on the base case timber supply. However, given the need for more analysis specific to the TFL—as opposed to applying area-weighted constraints derived from the adjacent Okanagan TSA—it is not clear that the magnitude of this downward influence is accurately represented by the sensitivity analysis. I have considered this in my determination as discussed below in Reasons for decision.

- visually sensitive areas

Careful management of scenic areas near recreational sites, highways and lakes is an important IRM objective and is part of the BCFS mandate to manage the recreation resource. "Recreation resource" is defined in the *Forest Practices Code* to include a "scenic or wilderness feature or setting that has recreational significance or value." In order to manage such scenic features, visual landscape foresters in British Columbia, in collaboration with specialists in other parts of the world, have developed procedures for identifying and managing visually sensitive areas. These procedures incorporate both biophysical (e.g., slope, topography) and social factors to provide recommended visual quality objectives (VQOs) that specify an acceptable amount of visible disturbance in a given area.

To meet these objectives, constraints must be placed on timber harvesting, road building and other forest practices in the sensitive areas. The constraints are based on research and experience and on public preferences and acceptance of degrees of alteration of visual landscapes. The constraints are normally expressed in terms of forest cover requirements that relate to the maximum allowable percentage of a viewshed that can be harvested at any one time, and to "visually effective green-up"—that is, the stage at which regeneration has been shown to be visually acceptable to the public.

A visual landscape inventory for TFL 49 was completed in 1993 and has been accepted by the Kamloops Forest Regional Manager. The inventory includes areas where visual quality is of potential significance. Consistent with the *Forest Practices Code*, VQOs for TFL 49 were established by the Penticton and Vernon District Managers on April 26, 1996 and November 12, 1996 respectively.

In the base case, the licensee applied forest cover constraints to each of three different VQO zones covering approximately 19 590 hectares of the productive forest on TFL 49. At the time of the analysis, Riverside used standard BCFS procedures to determine the proportion of allowable disturbance and the minimum green-up ages for each VQO zone. In the base case, visually effective green-up was assumed to occur at a five-metre site height. In a sensitivity analysis, Riverside showed show that increasing the green-up height to six metres—as was used in the 1994 timber supply analysis for the Okanagan TSA—from five metres had no impact on the base case harvest flow.

The licensee also provided a sensitivity analysis to demonstrate the impact of changing the allowable percent disturbance in the VQO zones. Increasing the allowable disturbance by three percent increased the base case timber supply by 3.4 percent in the long-term. Conversely, decreasing the allowable disturbance produced a moderate reduction to medium-term timber supply but had no impact in the first decade.

For this analysis the licensee used acceptable procedures to model visually sensitive areas. I acknowledge that VQOs have been designated for TFL 49 and note that the licensee adequately modelled these objectives in the timber supply analysis. I therefore find the information acceptable for use in this determination.

- biodiversity

Biological diversity, or biodiversity, is defined as the full range of living organisms, in all their forms and levels of organization, and includes the diversity of genes, species and ecosystems, and the evolutionary and functional processes that link them. Under the *Forest Practices Code*, biodiversity in a given management unit is assessed and managed at the stand and landscape levels. In the timber supply analysis for TFL 49, areas both within and outside of the timber harvesting land base were assumed to contribute to meeting biodiversity requirements.

- stand-level biodiversity

Stand-level biodiversity is managed by retaining reserves of mature timber, or wildlife tree patches, within cutblocks and in adjacent inoperable and other retained areas to provide structural diversity and wildlife habitat.

In the timber supply analysis for TFL 49, Riverside used computer (GIS) methods to buffer all areas previously deducted from the productive land base with a 250-metre wide band. The licensee assumed that the area more distant than the 250 metre buffer required retention of wildlife tree patches. The licensee then applied procedures in the *Biodiversity Guidebook* to estimate the proportion of additional area required for wildlife tree patches. Using this technique, Riverside deducted 5501 hectares—approximately four percent of the productive forest—to account for stand level biodiversity.

BCFS District staff and BC Environment specialists support the assumptions and approach used in the analysis. The licensee also provided a sensitivity analysis which showed that the retention of wildlife trees has a significant medium- to long-term impact on timber supply compared to the base case harvest flow.

I find the assumptions used in the base case to account for wildlife tree patches are consistent with the provisions of the *Biodiversity Guidebook* as well as with my experience in similar interior units. The licensee used an acceptable methodology and I therefore accept the information as modelled and find it appropriate for use in this determination.

- *landscape-level biodiversity*

Landscape-level biodiversity objectives involve maintaining forests with a variety of patch sizes, seral stages, and forest stand attributes and structures across a variety of ecosystems and landscapes. The *Biodiversity Guidebook* is based in part on the principle that maintaining such attributes and structures, together with connectivity of ecosystems and the maintenance of forested areas of sufficient size to maintain forest interior habitat conditions, will provide for the habitat needs of most forest and range organisms.

A major consideration in managing for biodiversity at the landscape level is leaving sufficient and appropriately located patches of old-growth forests for species dependent on, or strongly associated with, old-growth forests. Although some general forest management practices can broadly accommodate the needs of most species, more often a variety of practices is needed to represent the different natural disturbance patterns under which specific ecosystems have evolved. Natural disturbance patterns vary from frequent wildfires in the dry interior regions to rare stand disturbance events in the wetter coastal regions.

The delineation and formal designation of "landscape units" is a key component of a subregional biodiversity management strategy. A range of biodiversity emphasis options may be employed when establishing biodiversity management objectives for a landscape unit. The *Biodiversity Guidebook* outlines three biodiversity emphasis options—lower, intermediate and higher. If a reasonable distribution of options is maintained across the land base, it is generally considered that biodiversity can be maintained in conjunction with harvesting options.

For areas where landscape units have not been formally established, or an emphasis option has not been assigned for a landscape unit, in accordance with the *Biodiversity Guidebook*, the lower biodiversity emphasis option is used as a default to guide operations pending establishment of landscape units and objectives. Current government policy, intended to balance social and economic impacts against the risk to biodiversity, stipulates that the eventual distribution of emphasis options within a sub-regional planning unit should include approximately 45 percent of the area within the lower, 45 percent in the intermediate, and ten percent within the higher biodiversity emphasis options.

For landscape units where old seral forests are in short supply but the economic and social consequences are deemed unacceptable, the *Biodiversity Guidebook* allows additional harvesting flexibility. In these cases a minimum of one third of the old seral forest retention objective in low emphasis areas described in the guidebook must be retained and the shortfall recruited over time so that the intended old seral forest retention objective is in place within three rotations.

Four draft landscape units overlapping TFL 49 have been delineated, namely the Upper Salmon, Okanagan West, Pennask and Trepanier landscape units. Because the portion of the Pennask landscape unit overlapping TFL 49 represents only two percent of the timber harvesting land base within the TFL, Riverside combined it with the Trepanier landscape unit to simplify the analysis. Biodiversity emphasis options have not yet been established on TFL 49, therefore in the base case seral stage constraints were modelled using the accepted distribution of biodiversity emphasis, consistent with the government policy described above.

In the base case several factors concerning landscape level biodiversity were modelled using assumptions that do not coincide with current policy. Landscape level biodiversity constraints were modelled at the biogeoclimatic zone level rather than the currently accepted and required variant level. For low emphasis biodiversity areas the old seral constraint was modelled at one third of the requirement for the entire forecast period rather than increasing it over time to attain the full requirement in three rotations (approximately 210 years). In addition, recruitment of stands to meet old seral requirements was modelled to take place only within the productive area that does not contribute to timber supply. The timber harvesting land base was not included to ensure that old seral objectives are met as closely and as soon as possible.

The licensee provided several sensitivity analyses investigating these issues. Results indicate that varying each of these factors does not impact the short-term timber supply projected in the base case. Impacts were confined to the medium- and long-term and I concluded that the magnitude of these impacts adds no significant risk to this decision.

In consideration of the above information, in addition to the fact that landscape units and biodiversity emphasis options have not yet been formally designated, I believe that current landscape-level biodiversity requirements can be accommodated within the TFL 49 timber supply analysis. The licensee has demonstrated that the minimum landscape-level requirements consistent with existing government policy can be achieved in the short-term. For this determination, I accept the landscape level biodiversity assumptions as modelled, noting that once the landscape units and biodiversity emphasis options have formally been established, the potential timber supply impacts will be incorporated into future timber supply analyses.

(vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber;

Okanagan/Shuswap Land and Resources Management Plan

In addition to the *Ministry of Forests Act* and the *Forest Practices Code of B.C. Act*, the *Okanagan/Shuswap Land and Resources Management Plan* (LRMP) will provide regional planning guidance to the management of forest and range resources in the region.

The plan, scheduled for completion in 1999, will identify additional protected areas in the Southern Interior as well as delineate the boundaries of resource management zones and their associated management objectives.

While 10 860 hectares within TFL 49 have been identified as candidates for eventual protection, no decisions have yet been finalized by government. Consistent with my Guiding Principles, I therefore cannot speculate on the potential implications of removing all or some of these areas from TFL 49, nor can I consider the impact on timber supply of eventual approved management practices within specific resource management zones. I acknowledge that completion and implementation of the LRMP may in future impact the timber supply of TFL 49 and am mindful that subsequent determinations for TFL 49 will reflect the ongoing implementation of the LRMP.

Twenty-year plan

The purpose of the 20-year plan is to show if the harvest volume projected in the base case over the next 20 years can be appropriately configured in specific areas on the landscape. Because TFL 49 extends across the boundaries of both the Penticton and Vernon Forest Districts, Riverside prepared a 20-year plan for the areas within each district.

The 20-year plan was conditionally accepted by both BCFS District Managers. Concerns were expressed that the proportion of recently harvested areas in some community watersheds is unusually high. The proposed cutblock and road locations in several watersheds were also identified as concerns. While BCFS District Managers have approved the plans, to address these concerns, they suggest that hydrologic assessments should be undertaken in some watersheds over the term of the 20-year plan.

I recognize that it may be difficult for the licensee to distribute the proposed harvest exactly as configured in the 20-year plan. I am also mindful that the 20-year plan is not an operational plan and recognize that it provides just one alternative distribution of the proposed harvest over time. I am satisfied that for the first five-year period, the initial harvest level in the base case can be achieved and therefore find the 20-year plan appropriate for use in this determination.

TFL 49 boundary adjustment

During the term of MP No. 2, the boundaries of TFL 49 were reviewed and the total land base was reduced from 144 923 hectares to 143 760 hectares—the area used in the base case timber supply analysis.

Riverside has further examined the location of the boundaries using Geographic Positioning System (GPS) technology and dispute the conclusions that led to the reduction to the TFL area. Based on their review, Riverside indicated that the area of TFL 49 should be 144 726 hectares—966 hectares larger than the total area used in deriving the base case harvest forecast. BCFS Penticton and Vernon District staff accept Riverside's latest boundary survey and the revised TFL area. The licensee provided a sensitivity analysis to demonstrate the impact on the base case timber supply of adding approximately 1000 hectares to the TFL area. The sensitivity analysis showed an increase in long-term timber supply of less than two percent.

I accept that the total land base of TFL 49 may be underestimated by approximately 1000 hectares. While it is unclear precisely what proportion of this area contributes to the timber harvesting land base, I find that the increased area will likely provide a small increase in long-term timber supply and have discussed this further in my Reasons for decision.

(b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area;

Alternative harvest flows

In addition to the base case forecast, the licensee provided several alternative harvest forecasts.

One alternative tested the highest initial harvest level that could be attained with a maximum decline rate of 10 percent per decade and a medium-term harvest level that did not fall below the base case harvest projection. An initial harvest level of 410 000 cubic metres per year was achieved in this alternative.

The licensee also provided a harvest projection which showed an initial harvest level of 380 000 cubic metres per hectare, followed by a maximum rate of decline of 15 percent per decade to an even harvest flow. This harvest forecast showed that a more rapid decline is possible with no reduction to the long-term harvest level.

A third alternative harvest forecast—the "Riverside Harvest Option"—used assumptions different from those applied in the base case. In this option, the licensee increased existing stand yields by 15 percent; adjusted old growth site indexes on all three blocks; added the entire 1000 hectare boundary adjustment (discussed above) to the timber harvesting land base; and modelled landscape-level biodiversity at one third of the old seral stage requirement. Applying these assumptions, the licensee demonstrated that the initial harvest level of 380 000 cubic metres per year could be maintained for five decades before declining.

These harvest projections demonstrate that considerable flexibility in the magnitude and duration of the initial harvest level exists on TFL 49. This flexibility in the choice of an initial harvest level indicates that, to the extent that assumptions in the base case may not have adequately accounted for specific factors, these may still be accommodated for with acceptable rates of decline. I have been mindful of this flexibility in making my determination.

(c) the nature, production capabilities and timber requirements of established and proposed timber processing facilities;

Timber processing facilities

Logs harvested from TFL 49 are directed to the licensee's Kelowna and Armstrong manufacturing facilities. Both facilities operate a plywood plant and a stud mill. Mill requirements of the Kelowna and Armstrong facilities are approximately 674 200 and 842 700 cubic metres per year respectively. TFL 49 contributes approximately 35 percent of the volume supplying the Armstrong and Kelowna operations. The balance originates largely from the company's forest licenses in the Okanagan, Kamloops, and Merritt TSAs and includes significant purchases from private operators in the region.

Other operations near TFL 49 include a veneer plant and stud mill at Lumby, a box and pallet plant at Winfield and other processing facilities throughout southern interior B.C.

I note the contribution of the TFL 49 timber harvest to the licensee's local operations is significant, and have considered this in my determination.

(d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia; and

Minister's letters and memorandum

The Minister has expressed the economic and social objectives of the Crown in two documents to the chief forester—a letter dated July 28, 1994, (attached as Appendix 3) and a memorandum dated February 26, 1996, (attached as Appendix 4). I understand both documents to apply to TFL 49. They are consistent with the objectives stated in the Forest Renewal Plan and include forest stewardship, a stable timber supply, and allowance of time for communities to adjust to harvest-level changes in a managed transition from old-growth to second-growth forests, so as to provide for community stability.

The Minister stated in his letter of July 28, 1994, that "any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability." He placed particular emphasis on the importance of long-term community stability and the continued availability of good forest jobs. To this end, he asked that the chief forester consider the potential impacts on timber supply of commercial thinning and harvesting in previously uneconomical areas. To encourage this, the Minister suggested consideration of partitioned AACs. I have reviewed the opportunities for commercial thinning, and as discussed under *commercial thinning* the licensee currently has no plans to include this in its operations.

The Minister's memorandum addressed the effects of visual resource management on timber supply. It asked that pre-*Code* constraints applied to timber supply in order to meet VQOs be re-examined when determining AACs in order to ensure they do not unreasonably restrict timber supply. I have discussed this above under "*visually sensitive areas*," where I considered the VQOs on TFL 49 and have made no further adjustments to the timber supply estimate from that projected in the base case.

Local objectives

The Minister's letter of July 28, 1994, states that the chief forester should consider important social and economic objectives that may be derived from the public input in the timber supply review where these are consistent with government's broader objectives.

The licensee took a number of steps to provide opportunities for public review of the draft statement of management objectives, options, and procedures (SMOOP); draft MP No. 3; 20-year harvest plan; and timber supply analysis by advertising in local newspapers, holding open houses, and making the documents available for public viewing.

The licensee received one written submission from the Shuswap Nation Tribal Council (discussed below). Although no other public response was received, I have considered the general employment and community stability implications of TFL 49 in my AAC determination.

First Nations

In a written submission to Riverside, the Shuswap Nation Tribal Council expressed general concerns regarding aboriginal title and rights to the lands and resources within its traditional territory including TFL 49. I respect the Council's intention to enter into land claim negotiations with the provincial government and as discussed above under "Guiding Principles", my determination should in no way be construed as limiting the government's legal obligations with respect to First Nations issues. I note that no specific concerns affecting timber supply such as significant cultural sites have been raised to date. Should additional areas be identified, any impacts can be reflected in future determinations to the extent that they may affect timber supply.

(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

Insect damage

Significant insect pests on TFL 49 include the mountain pine beetle, spruce bark beetle and western balsam bark beetle. Riverside conducts an ongoing monitoring program to identify infested or susceptible stands. Affected stands are given priority harvest to minimize further damage.

The licensee presented a sensitivity analysis to show the impact of assigning a priority to harvesting lodgepole pine stands. This sensitivity analysis simulates the potential impact of a mountain pine beetle infestation whereby affected lodgepole pine stands would be harvested to control the spread to susceptible stands. The sensitivity analysis demonstrates that timber supply is increased by a small amount in the medium-term when lodgepole pine stands are assigned a priority for harvesting.

I acknowledge that infestations are subject to many biological and climatic factors and are difficult to predict or control. Although the sensitivity analysis does not reflect current performance, it does suggest additional flexibility within the timber supply should a major mountain pine beetle infestation require a dramatic shift in the harvest profile. Having reviewed the information and assumptions used, I conclude that the analysis adequately represents insect damage and therefore find it suitable for this determination.

Root rots

The incidence of stands affected by root rot can be particularly severe within the Interior Cedar-Hemlock (ICH) and Interior Douglas-Fir (IDF) biogeoclimatic zones. About 39 percent of the TFL 49 timber harvesting land base is within these two zones. BCFS Research Branch staff estimate that yields in affected stands are approximately 20 to 30 percent below those projected using the TIPSY growth and yield model. This reduction to stand volume is in addition to the reductions described previously under *operational adjustment factors*.

To approximate the potential impacts on timber supply of root rots, the licensee pro-rated the estimated reductions in the ICH and IDF zones to the entire TFL. Riverside then used the resulting estimates in a sensitivity analysis to demonstrate the potential impact of root rot infection on the base case harvest forecast. The analysis showed a significant downward impact on long-term timber supply but no short-term impact to the base case harvest flow.

Riverside indicates that while root rot does exist on the TFL, not all stands within the ICH and IDF are affected. The licensee therefore maintains that the impacts of root rots on the base case harvest flow are less than suggested by the sensitivity analysis. While I have no information to dispute these claims, I nonetheless request the licensee work to compile more explicit information on root rots specific to TFL 49 before the next analysis.

In the meantime, for the purposes of this determination I consider that the incidence of root rots on TFL 49 represents an unquantified reduction in long-term timber supply compared to the base case forecast and have considered this in my Reasons for decision.

Unsalvaged losses

Unsalvaged losses are timber volumes destroyed or damaged by natural causes such as fire and disease, but not recovered through salvage operations.

In the base case, the licensee applied estimates used in the draft Okanagan/Shuswap Land and Resource Management Plan (LRMP) data package. Using this approach, losses to insects and wind were estimated to be 12 800 and 2800 cubic metres per year respectively, or approximately four percent of the AAC under MP No. No separate allowances were made for fire. The licensee maintains that fire has been virtually eliminated from the TFL and an extensive and accessible road network covers the majority of the TFL, facilitating efficient salvage operations.

BCFS staff have reviewed the approach and assumptions used in the base case and find the estimates for insects and wind damage to be adequate. Although the licensee has used the best available information, I note there is still considerable uncertainty in the estimates. For example, significant timber losses from wildfire occurred this past summer in the region. While these losses occurred outside of the TFL, their close proximity suggests that wildfire remains an important concern in the area. As discussed above, the incidence of root rot and the related impacts on timber supply are also uncertain and I request that the licensee work to compile more local information on unsalvaged losses specific to this TFL. I will consider any new findings in future analyses.

For this determination, in the absence of better information, I accept the accounting for unsalvaged losses as modelled.

Reasons for decision

In reaching my decision on an AAC for TFL 49, I have considered all of the factors presented above and have reasoned as follows:

For the reasons stated in "Timber supply analysis", and from reviewing the considerations as recorded above, I accept the licensee's base case as an adequate basis from which to assess timber supply for this AAC determination.

In determining AACs, my considerations typically identify factors which, considered separately, indicate that the timber supply may be either greater or less than that projected in the base case. Some of these factors can be quantified and their impacts assessed with some reliability. Others may influence timber supply by adding an element of risk or uncertainty to the decision but cannot be reliably quantified at the time of the determination. These latter factors are accounted for in determinations in more general terms.

The following factors have been identified as reasons why the timber supply projected in the base case may have been slightly underestimated to an extent that may be *quantified*:

- *utilization standards:* the licensee assumed a 30 centimetre stump height in the timber supply analysis. However, except during periods of heavy snow pack, Riverside's current practice is to harvest stands to a 20 centimetre stump height. I concluded that the base case harvest forecast is underestimated by an amount that does not exceed one percent.

- *TFL boundary adjustment:* since completion of the timber supply analysis, the licensee reviewed the boundaries and found the total area of TFL 49 was 966 hectares larger than the total area used to derive the timber harvesting land base. Although it is uncertain exactly what proportion of this area contributes to the timber harvesting land base, the licensee's sensitivity analysis demonstrated a potential increase compared to the base case of up to two percent in the medium and long term.

Counteracting the underestimates described above, one factor was identified that exerts a downward influence on the base case timber supply projection to a degree that may be *quantified*:

- *roads, trails and landings*: estimates for productivity losses due to roads, trails and landings are underestimated in the base case. A review of this factor suggested that the timber supply harvest projection in the base case is overestimated by up to 1.2 percent

Two additional but *unquantified* factors that exert a potential downward influence on timber supply were also identified:

- *not satisfactorily restocked areas*: I concluded that in the timber supply analysis, the modelling technique used to account for NSR areas caused a small overestimate of timber supply in the medium- to long term compared to the base case harvest forecast.

- *riparian areas:* BCFS District staff estimate that approximately 424 hectares of lakeshore reserves and 3100 hectares of lakeshore management zones were not fully accounted for in the timber supply analysis. I concluded that timber supply is overestimated in the base case harvest forecast by less than one percent.

In assessing the above factors I have concluded that those indicating underestimation (utilization standards, TFL boundary adjustment) and those indicating overestimation (existing roads, trails and landings, and not-sufficiently-restocked areas) areas work to counteract one another. Although the data I have reviewed do not allow firm quantification, a general assessment of the these factors suggests that their combined influences on timber supply amount to an approximate offset and present no significant net risk to the viability of the base case projection.

Other factors were identified as contributing to a potentially large underestimation of timber supply but to a degree that cannot be quantified with accuracy:

- *inventory (existing stand yields)*: I note that Vegetation Resources Inventory Phase II sampling was used to broadly assess the accuracy of the inventory and am mindful of the limitations of the methods used. The results of the assessment suggested that the existing mature stand volumes may be underestimated by up to 15 percent. Sensitivity analysis showed that when existing mature stand volumes were increased by 15 percent, the initial harvest level could be maintained for an additional two decades compared to the base case harvest projection.

- *site productivity estimates*: the licensee used ecosystem site association data to adjust old growth site indexes in block B. No corresponding information was available for blocks A and C. However, the licensee applied provincial old growth site index (OGSI) adjustment equations to blocks A and C in a sensitivity analysis. The analysis suggests that the medium- and long-term timber supply are underestimated by 24 percent and 12 percent respectively.

Counteracting factors were identified as contributing to a potential overestimation of the timber supply to a degree that currently cannot be quantified with accuracy:

- *regeneration*: the regeneration assumptions used in the timber analysis do not entirely reflect operational practice. Douglas-fir and balsam stands are not regenerated to the species mix that was assumed in the analysis. While the impact on timber supply of modelling the appropriate species combinations used to regenerate these stands is uncertain, I concluded that the base case harvest forecast may be overestimated by up to six percent in the medium to long term.

- *root rot*: root rot is known to occur in some areas on TFL 49. BCFS Research Branch staff estimate that future yields in affected stands may be 20 to 30 percent below those projected using the TIPSY growth and yield model. While the incidence and extent of affected stands is uncertain, a sensitivity analysis provided by the licensee showed a potential downward impact on long-term timber supply of up to seven percent.

- *partial cutting*: In the timber supply analysis, the entire area was modelled as being clearcut with no specific accounting made for the proportionately small area currently harvested using partial cutting systems. The licensee provided a sensitivity analysis to simulate the potential impact of using partial cutting systems on the TFL. While I note that the methods used to model alternative silviculture systems are subject to considerable uncertainty, the analysis showed a potential five percent decrease to the long-term harvest level.

- *community watersheds*: I have reviewed the information on community watersheds and found that the management regime that will be applied within the watershed areas, while currently uncertain, may be more restrictive to timber harvesting than was assumed in the base case. The licensee provided a sensitivity analysis that suggested a significant but unquantified overestimation of the base case timber supply in the medium-term.

Reviewing the unquantifiable factors above I have considered as follows: In the timber supply analysis, the licensee provided an additional timber supply forecast—the "Riverside Harvest Option"—as discussed under Alternate harvest flows. In this option the licensee incorporated adjusted old growth site indexes in blocks A and C, (in addition to those already accounted for in block B) increased existing stand yields by 15 percent, and modelled landscape-level biodiversity at one third of the old seral stage requirement. Applying all the potentially positive influences on timber supply would allow the initial harvest level in the base case (380 000 cubic metres per year) to be maintained for an additional five decades as well as increase the long-term harvest forecast by up to 13 percent. Reviewing this alternative harvest projection and considering the potential influence of the unquantified downward factors (*regeneration, root rot, partial cutting* and *community watersheds*) on timber supply, I conclude there is little likelihood that their combined effect will offset the potential underestimations of timber supply reflected in the *inventory* and estimates of *site productivity*. Moreover, the impact of *regeneration* and *root rot*, while potentially underestimating timber supply by up to six and seven percent respectively, work primarily in the long term and present little risk to short-term timber supply. I note the potential impact of partial cutting on timber supply is also primarily a long-term issue, and most yield modelling completed to date elsewhere in the province has not demonstrated significant reductions in timber supply compared to clearcut systems. A review of the 20-year plan further confirms that the existing AAC can be spatially configured for at least another 20 years in the TFL without compromising resource management objectives.

Having considered and reviewed all the factors documented above, and taking into account the risk and uncertainty associated with the information provided, it is my conclusion that the base case projected harvest level of 380 000 cubic metres per year represents a suitable harvest level for TFL 49 at this time.

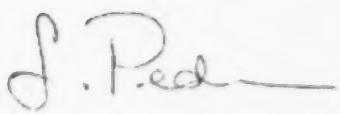
Determination

It is my determination that a timber harvest level that accommodates objectives for all forest resources during the next five years, that reflects the socio-economic objectives of the Crown for the area, that ensures longer-term IRM objectives can be met, that reflects current management practices, can best be achieved in TFL 49 at this time by establishing an AAC of 380 000 cubic metres.

Implementation

This determination comes into effect on December 22, 1998 and will remain in effect until a new AAC is determined, which must take place within five years of the effective date of this determination. In the period following this determination and leading to the subsequent determination, I expect the licensee to:

- thoroughly review the riparian inventory including stream classification as well as the associated modelling assumptions before the next analysis;
- review and refine operational adjustment factors (OAFs);
- review modelling assumptions around not-satisfactorily-restocked (NSR) areas;
- provide more explicit modelling of partial cutting systems and the impacts of their expanded application to TFL 49;
- improve the methodology for modelling stump heights in the next timber supply analysis; and,
- in collaboration with MELP and BCFS staff, clarify management practices and modelling assumptions for community watersheds.



Larry Pedersen

Chief Forester

May 10, 1999

Appendix 1: Section 8 of the *Forest Act*

Section 8 of the Forest Act, Revised Statutes of British Columbia 1996, reads as follows:

8. Allowable annual cut

8. (1) The chief forester must determine an allowable annual cut at least once every 5 years after the date of the last determination, for

(a) the Crown land in each timber supply area, excluding tree farm licence areas, community forest agreement areas and woodlot licence areas, and

(b) each tree farm licence area.

(2) If the minister

(a) makes an order under section 7 (b) respecting a timber supply area, or

(b) amends or enters into a tree farm licence to accomplish a result set out under section 39 (1) (a) to (d),

the chief forester must make an allowable annual cut determination under subsection (1) for the timber supply area or tree farm licence area

(c) within 5 years after the order under paragraph (a) or the amendment or entering into under paragraph (b), and

(d) after the determination under paragraph (c), at least once every 5 years after the date of the last determination.

(3) If

(a) the allowable annual cut for the tree farm licence area is reduced under section 9 (3), and

(b) the chief forester subsequently determines, under subsection (1) of this section, the allowable annual cut for the tree farm licence area,

the chief forester must determine an allowable annual cut at least once every 5 years from the date the allowable annual cut under subsection (1) of this section is effective under section 9 (6).

(4) If the allowable annual cut for the tree farm licence area is reduced under section 9 (3), the chief forester is not required to make the determination under subsection (1) of this section at the times set out in subsection (1) or (2) (c) or (d), but must make that determination within one year after the chief forester determines that the holder is in compliance with section 9 (2).

(5) In determining an allowable annual cut under subsection (1) the chief forester may specify portions of the allowable annual cut attributable to

(a) different types of timber and terrain in different parts of Crown land within a timber supply area or tree farm licence area,

(b) different types of timber and terrain in different parts of private land within a tree farm licence area, and

(c) gains in timber production on Crown land that are attributable to silviculture treatments funded by the government of British Columbia, the federal government, or both.

(6) The regional manager or district manager must determine a volume of timber to be harvested from each woodlot licence area during each year or other period of the term of the woodlot licence, according to the licence.

(7) The regional manager or the regional manager's designate must determine a volume of timber to be harvested from each community forest agreement area during each year or other period, in accordance with

(a) the community forest agreement, and

(b) any directions of the chief forester.

(8) In determining an allowable annual cut under subsection (1) the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

(a) the rate of timber production that may be sustained on the area, taking into account

(i) the composition of the forest and its expected rate of growth on the area,

(ii) the expected time that it will take the forest to become re-established on the area following denudation,

(iii) silviculture treatments to be applied to the area,

(iv) the stand of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area,

(v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production, and

(vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber,

(b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area,

(c) the nature, production capabilities and timber requirements of established and proposed timber processing facilities,

(d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia, and

(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

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Appendix 2: Section 4 of the *Ministry of Forests Act*

Section 4 of the *Ministry of Forests Act* (consolidated 1988) reads as follows:

Purposes and functions of ministry

4. The purposes and functions of the ministry are, under the direction of the minister, to

(a) encourage maximum productivity of the forest and range resources in the Province;

(b) manage, protect and conserve the forest and range resources of the Crown, having regard to the immediate and long term economic and social benefits they may confer on the Province;

(c) plan the use of the forest and range resources of the Crown, so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated, in consultation and cooperation with other ministries and agencies of the Crown and with the private sector;

(d) encourage a vigorous, efficient and world competitive timber processing industry in the Province; and

(e) assert the financial interest of the Crown in its forest and range resources in a systematic and equitable manner

Documents attached:

Appendix 3: Minister of Forests' letter of July 28, 1994

Appendix 4: Minister of Forests' memo of February 26, 1996

File: 10100-01

JUL 28 1994

John Cuthbert
Chief Forester
Ministry of Forests
595 Pandora Avenue
Victoria, British Columbia
V8W 3E7

Dear John Cuthbert:

Re: Economic and Social Objectives of the Crown

The *Forest Act* gives you the clear responsibility for determining Allowable Annual Cuts, decisions with far-reaching implications for the province's economy. The *Forest Act* provides that you consider the social and economic objectives of the Crown, as expressed by me, in making these determinations. The purpose of this letter is to provide this information to you.

The social and economic objectives expressed below should be considered in conjunction with environmental considerations as reflected in the Forest Practices Code, which requires recognition and better protection of non-timber values such as biodiversity, wildlife and water quality.

The government's general social and economic objectives for the forest sector are made clear in the goals of the Forest Renewal Program. In relation to the Allowable Annual Cut determinations you must make, I would emphasize the particular importance the government attaches to the continued availability of good forest jobs and to the long-term stability of communities that rely on forests.

Through the Forest Renewal Plan, the government is taking the steps necessary to facilitate the transition to more value-based management in the forest and the forest sector. We feel that adjustment costs should be minimized wherever possible, and to this end, any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability.

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Province of [illegible] Minister of [illegible]
Parliament Buildings
V8V 1X4 [illegible]

In addition to the provincial perspective, you should also consider important local social and economic objectives that may be derived from the public input on the Timber Supply Review discussion papers where these are consistent with the government's broader objectives.

Finally, I would note that improving economic conditions may make it possible to harvest timber which has typically not been used in the past. For example, use of wood from commercial thinnings and previously uneconomic areas may assist in maintaining harvests without violating forest practices constraints. I urge you to consider all available vehicles, such as partitioned cuts, which could provide the forest industry with the opportunity and incentive to demonstrate their ability to utilize such timber resources.

Yours truly,

Andrew Petter
Minister

Province of British Columbia
Ministry of Forests
OFFICE OF THE MINISTER

MEMORANDUM

File: 16290-01

February 26, 1996

To: Larry Pedersen
Chief Forester

From: The Honourable Andrew Petter
Minister of Forests

Re: The Crown's Economic And Social Objectives Regarding Visual Resources

Further to my letter of July 29, 1994, to your predecessor, wherein I expressed the economic and social objectives of the Crown in accordance with Section 7 of the *Forest Act*, I would like to elaborate upon these objectives as they relate to visual resources.

British Columbia's scenic landscapes are a part of its heritage and a resource base underlying much of its tourism industry. They also provide timber supplies that are of significant economic and social importance to forest industry dependent communities.

Accordingly, one of the Crown's objectives is to ensure an appropriate balance within timber supply areas and tree farm licence areas between protecting visual resources and minimizing the impact of such protection measures on timber supplies.

As you know, I have directed that the policy on management of scenic landscapes should be modified in light of the beneficial effects of the Forest Practices Code. In general, the new policy should ensure that establishment and administration of visual quality objectives is less restrictive on timber harvesting. This change is possible because alternative harvesting approaches as well as overall improvement in forest practices will result in reduced detrimental impacts on visually sensitive areas. Also, I anticipate that the Forest Practices Code will lead to a greater public awareness that forest harvesting is being conducted in a responsible, environmentally sound manner, and therefore to a decreased public reaction to its visible effects on the landscape. In relation to the Allowable Annual Cuts determinations that you make, please consider the effects that the new policy will have in each Timber Supply Area and Tree Farm Licence.

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In keeping with my earlier letter, I would re-emphasize the Crown's objectives to ensure community stability and minimize adjustment costs as the forest sector moves to more value-based management. I believe that the appropriate balance between timber and visual resources will be achieved if decisions are made consistent with the ministry's February 1996 report *The Forest Practices Code: Timber Supply Analysis*.

Finally, in my previous letter I had asked that local economic and social objectives be considered. Please ensure that local views on the balance between timber and visual resources are taken into account within the context of government's broader objectives.

Andrew Petter
Minister of Forests